

TABLE 2.—Solar and sky radiation received on a horizontal surface

[Gram-calories per square centimeter of horizontal surface]

Week beginning—	Average daily radiation						Average daily departure from normal		
	Wash- ington	Madi- son	Lin- coln	Chi- cago	New York	Twin Falls	Wash- ington	Madi- son	Lin- coln
1928	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
Apr. 1	436	237	378	175	407	324	+51	-137	-36
Apr. 8	347	490	475	294	309	377	-59	+75	+51
Apr. 15	415	435	423	390	432	312	-12	+29	-23
Apr. 22	288	528	620	376	237	367	-130	+94	+140
Excess or deficiency since first of year on Apr. 28							-616	+1,002	+259

## POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. C. S. Freeman, Superintendent, U. S. Naval Observatory]  
 [Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson observatories]

[The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi- tude	Lat- itude	Spot	Group	
1928							
Apr. 1 (Naval Observa- tory).	h. m. 14 16	° -72.0	° 228.5	° -8.5	123		
		-58.5	242.0	+20.5	62		
		-28.0	272.5	+10.0	77		
		-23.0	277.5	+8.0	77		
		-12.0	288.5	+22.0		170	
		-5.0	295.5	+9.5		22	
		-4.5	296.0	+6.0	31		
		+48.5	340.0	-11.0	123		685
Apr. 2 (Naval Observa- tory).	11 42	-83.0	205.7	-17.0		463	
		-60.5	228.2	-9.0	123		
		-45.0	243.7	+20.5	15		
		-17.5	271.2	+10.5	62		
		-11.0	277.7	+8.0		154	
		-2.5	286.2	+6.5		6	
		-1.5	287.2	+22.0	154		
		+7.5	296.2	+10.0		9	
		+8.0	296.7	+6.5	31		
		+60.5	349.2	-11.0	123		1,140
Apr. 3 (Naval Observa- tory).	11 48	-70.5	204.9	-17.0		494	
		-67.5	207.9	-24.5		62	
		-47.0	228.4	-9.0	93		
		-4.0	271.4	+10.5	37		
		-1.0	274.4	+7.5	139		
		+5.0	280.4	+8.0		62	
		+11.5	286.9	+22.0	139		
		+12.0	287.4	+7.0		46	
		+21.5	296.9	+7.5		25	
		+73.5	348.9	-11.0	123		1,220
Apr. 4 (Naval Observa- tory).	11 32	-70.0	192.4	-10.0	15		
		-68.0	194.4	-15.0	31		
		-67.0	195.4	+17.0		185	
		-60.0	202.4	-13.5		216	
		-55.0	207.4	-17.0	370		
		-52.0	210.4	-22.5	31		
		-33.0	229.4	-8.5	62		
		+10.0	272.4	+10.5	31		
		+12.5	274.9	+7.5		154	
		+18.0	280.4	+8.0	139		
		+24.5	286.9	+22.0	139		
		+27.0	289.4	+6.0		25	
		+34.5	296.9	+6.0	15		1,413
Apr. 5 (Naval Observa- tory).	11 39	-56.0	193.1	-10.5	15		
		-52.5	196.6	+17.0		123	
		-49.0	200.1	-14.0		185	
		-42.5	206.6	-17.0	401		
		-40.0	209.1	-23.5		62	
		-19.5	229.6	-8.5	77		
		+4.0	253.1	+14.5	22		
		+22.5	271.6	+11.0	15		
		+29.5	278.6	+8.0		216	
		+38.0	287.1	+21.5	123		
		+48.0	297.1	+6.0	9		1,248
Apr. 6 (Naval Observa- tory).	11 37	-82.0	153.9	-15.5	154		
		-40.0	195.9	+17.0		154	
		-37.0	198.9	-14.0		247	
		-29.5	206.4	-17.0	463		
		-27.0	208.9	-24.0		62	
		-6.5	229.4	-8.0	77		
		+17.5	253.4	+14.5		31	
		+35.0	270.9	+11.0	15		
		+42.5	278.4	+8.0		154	
		+50.0	285.9	+21.5	123		1,480

Positions and areas of sun spots—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi- tude	Lat- itude	Spot	Group	
1928							
Apr. 7 (Naval Observa- tory).	h. m. 11 35	° -70.0	° 152.8	° -15.5	139		
		-36.5	186.3	-9.5		22	
		-32.5	190.3	+18.0		15	
		-26.0	196.8	+16.0	139		
		-22.0	200.8	-14.0		432	
		-16.5	206.3	-17.0	370		
		-13.5	209.3	-25.0		93	
		-3.0	219.8	-7.5		46	
		+7.0	229.8	-8.5	77		
		+29.0	251.8	+13.5		18	
		+49.0	271.8	+11.0	31		
		+52.0	274.8	+7.5	123		
		+59.5	282.3	+8.0		62	
		+61.5	284.3	+21.0	93		1,660
Apr. 8 (Naval Observa- tory).	11 36	-81.0	128.6	+13.0		463	
		-70.5	139.1	-16.0		62	
		-56.0	153.6	-15.5	123		
		-18.0	191.6	+17.5		31	
		-12.5	197.1	+15.5		139	
		-9.0	200.6	-14.0		432	
		-2.5	207.1	-17.0	370		
		-1.0	208.6	-25.0		139	
		+11.5	221.1	-8.0		77	
		+20.5	230.1	-9.0	77		
		+41.5	251.1	+13.0	9		
		+61.0	270.6	+11.0	31		
		+64.5	274.1	+7.5		139	
		+74.0	283.6	+21.0	123		2,215
Apr. 9 (Naval Observa- tory).	12 56	-66.0	129.6	+13.5		370	
		-59.5	136.1	-17.5		185	
		-41.5	154.1	-15.5		170	
		0.0	196.6	-16.0		93	
		+1.5	197.1	+15.0		93	
		+7.5	203.1	-15.0		401	
		+12.0	207.6	-17.5	247		
		+28.0	223.6	-7.5	46		
		+34.5	230.1	-8.5	77		1,682
Apr. 10 (Harvard)	16 17	-72.0	108.5	-12.0		204	
		-69.5	111.0	+7.0	388		
		-51.5	129.0	+12.0		1,022	
		-42.0	138.5	-19.5		104	
		-25.5	155.0	-16.0	119		
		+17.5	198.0	+15.5		67	
		+25.5	206.0	-14.0		818	
		+51.0	231.5	-7.0	47		2,769
Apr. 11 (Mount Wilson)	19 0	-56.0	109.9	-9.5		725	
		-56.0	109.9	+9.5	251		
		-37.0	128.9	+14.0		456	
		-30.0	135.9	-18.0		65	
		-12.0	153.9	-15.0		138	
		+2.0	167.9	-16.0		25	
		+31.0	196.9	+15.0		145	
		+38.0	203.9	-15.5		799	
		+62.0	227.9	-9.5	30		2,634
Apr. 12 (Naval Observa- tory).	11 49	-52.5	104.1	-10.5		154	
		-45.0	111.6	+8.5	247		
		-42.5	114.1	-8.0		278	
		-27.0	129.6	+13.0		216	
		-21.5	135.1	-19.5	31		
		-15.5	141.1	-16.0	25		
		-2.5	154.1	-15.5		93	
		+42.0	198.6	+14.5		62	
		+44.0	200.6	-15.0		216	
		+51.0	207.6	-17.0		370	1,692
Apr. 13 (Naval Observa- tory).	11 45	-40.0	103.5	-10.5	123		
		-31.0	112.5	+9.0		170	
		-29.0	114.5	-8.5		278	
		-12.5	131.0	+13.0		139	
		-8.0	135.5	-19.5	18		
		-2.5	141.0	-16.5	9		
		+10.5	154.0	-16.0		46	
		+55.0	198.5	+14.0	31		
		+57.0	200.5	-15.0		185	
		+63.0	206.5	-16.5		216	1,215
Apr. 14 (Mount Wilson)	18 30	-15.0	111.5	-10.0		304	
		-14.0	112.5	+8.5		222	
		+4.0	130.5	+13.0		85	
		+11.0	137.5	-18.0		22	
		+26.5	153.0	-16.0		36	
		+50.5	177.0	+18.0		60	
		+76.0	202.5	-14.0		219	948
Apr. 15 (Naval Observa- tory).	13 35	-12.0	104.1	-10.5		93	
		-5.0	111.1	-10.0		93	
		-3.5	112.6	+9.0		185	
		+1.0	117.1	-8.5	154		
		+14.5	130.6	+12.5		93	
		+38.5	154.6	-16.5		77	
		+58.0	174.1	+19.0	62		757
Apr. 16 (Naval Observa- tory).	12 12	+0.5	104.1	+7.0		31	
		+1.5	105.1	-9.5		46	
		+8.0	111.6	-10.0		15	
		+9.0	112.6	+10.0		185	
		+14.5	118.1	-7.5		170	
		+27.5	131.1	+15.0		106	
		+80.0	183.6	+19.0	123		678

## Positions and areas of sun spots—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi- tude	Lati- tude	Spot	Group	
1928							
Apr. 17 (Naval Observa- tory).	h. m. 11 58	°	°	°			
		-41.0	49.5	-10.0	6		
		+13.5	104.0	-9.0		9	
		+14.5	105.0	+7.5		9	
		+17.5	108.0	-9.5		6	
		+22.0	112.5	-10.0	25		
		+22.0	112.5	+10.0	154		
		+28.0	118.5	-7.5	123		
		+40.0	130.5	+17.5		46	378
Apr. 18 (Naval Observa- tory).	12 12	+35.0	112.2	-10.0	19		
		+35.5	112.7	+9.5	139		
		+41.0	118.2	-7.5	123		
		+53.5	130.7	+17.5		15	296
Apr. 19 (Naval Observa- tory).	13 7	-78.0	345.5	-11.0	204		
		-72.0	351.5	-9.5	31		
		+0.5	64.0	-8.0		15	
		+49.5	113.0	-10.5	9		
		+50.0	113.5	+9.0	170		
		+54.5	118.0	-7.5	93		522
Apr. 20 (Naval Observa- tory).	12 27	-65.0	345.6	-11.0	154		
		-59.5	351.1	-9.5		31	
		+12.5	63.1	-8.0		46	
		+60.5	111.1	-10.0	6		
		+61.5	112.1	+9.0	185		
		+67.5	118.1	-7.5	108		530
Apr. 21 (Harvard)-----	11 21	-51.0	347.0	-12.5	315		
		+79.5	117.5	+10.0	314		
		+87.0	125.0	-6.5	382		1,011
Apr. 22 (Mount Wilson).	12 45	-53.0	331.0	+9.5		49	
		-39.0	345.0	-12.0	307		356
Apr. 23 (Yerkes)-----	12 16	-25.0	347.0	-16.0	300		300
Apr. 24 (Naval Observa- tory).	11 36	-80.0	278.3	-18.0	93		
		-75.0	283.3	-13.5		185	
		-24.5	333.8	+8.5		25	
		-12.5	345.8	-12.0		185	498
Apr. 25 (Naval Observa- tory).	11 46	-79.0	266.0	-18.5		185	
		-72.0	273.0	-14.0	77		
		-69.0	276.0	-16.5		93	
		-61.5	283.5	-13.5	278		
		-17.5	327.5	+10.5		31	
		-12.0	333.0	+8.0		62	
		+0.5	345.5	-12.0	216		942
Apr. 26 (Naval Observa- tory).	11 42	-67.5	264.3	-18.5		185	
		-59.5	272.3	-14.0	77		
		-57.0	274.8	-17.0	31		
		-48.0	283.8	-13.5	247		
		-10.0	321.8	+18.0	9		
		+1.5	333.3	+8.0	31		
		+13.0	344.8	-12.0	154		734
Apr. 27 (Harvard)-----	10 20	-77.0	242.5	+9.5	786		
		-51.0	268.5	-18.0		317	
		-35.0	284.5	-14.5	393		
		+28.0	347.5	-11.5	271		1,767

## Positions and areas of sun spots—Continued

Date	Eastern standard civil time		Heliographic			Area		Total area for each day		
			Diff. long.	Longi- tude	Lati- tude	Spot	Group			
1928										
Apr. 28 (Mount Wilson)	h. m.	14 15	°	°	°					
			-67.0	236.9	+22.0		74			
			-59.0	244.9	+10.0		242			
			-38.0	265.9	-17.0		293			
			-20.0	283.9	-14.0	327				
			+30.0	333.9	+8.0		8			
Apr. 29 (Naval Observa- tory).	11 40		+42.0	345.9	-11.0	230		1,174		
			-58.0	234.2	+9.5		31			
			-54.5	237.7	+22.5		154			
			-48.0	244.2	+9.5		247			
			-35.0	257.2	+14.5	31				
			-27.5	264.7	-18.0		139			
Apr. 30 (Naval Observa- tory).	12 2		-20.0	272.2	-14.5	31				
			-8.5	283.7	-13.5	247				
			+54.5	346.7	-12.0	185		1,065		
			-77.5	201.2	-11.0		216			
			-70.0	208.7	-11.0		108			
			-41.0	237.7	+22.0		62			
Mean daily area for April.			-37.5	241.2	+9.0		46			
			-32.5	246.2	+10.5		216			
			-15.0	263.7	-13.5		22			
			-14.5	264.2	-19.0		40			
			-7.0	271.7	-14.0	25				
			+4.5	283.2	-13.5	185				
			+16.0	294.7	-19.0		31			
			+68.5	347.2	-12.0	154		1,111		
										1,137

## PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR APRIL, 1928

[Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland]

March	Relative numbers	March	Relative numbers	March	Relative numbers
1		11	125	21	22
2		12	110	22	21
3	76	13	93	23	24
4	95	14	82	24	28
5	111	15	91	25	44
6	126	16	82	26	52
7	121	17		27	50
8	136	18	26	28	55
9	134	19	39	29	67
10	109	20	40	30	92

Number of observations, 27; mean, 76.0.

## AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures were decidedly below normal for the month with the exception of those at Washington, where small positive departures occurred at most levels. In agreement with Climatological Chart 1, the largest negative departures occurred in the extreme northern and southern sections of the country. It will be seen from Table 1 that unusually large temperature departures persisted to the highest levels at Groesbeck, Ellendale, and Royal Center.

Notwithstanding the subnormal free-air temperatures, the average relative humidities were likewise below normal at practically all stations. This fact is apparently of significance in connection with the small amount of precipitation which occurred at most of the stations during the month, Royal Center having the smallest amount on record for April.

Vapor pressures averaged below normal at all stations and altitudes with the exception of the lower levels at Washington.

Free-air resultant wind velocities were considerably in excess of the average at Washington and Ellendale and near the average at the other stations. Resultant

directions for the month showed a decided lack of southerly component at most stations and levels. This was in harmony with the negative temperature departures.

Record minimum temperatures for April accompanied high-pressure areas on the 7th-9th, 14th, and 27th-28th. Temperature departures ranged from 20° C. below the average at 1,500 meters at Ellendale on the 8th to 14° C. below at 2,000 meters at Due West on the 28th.

Conditions of special interest occurred on the 27th and 28th when northeasterly winds prevailed at exceptionally high altitudes over the Lake region. At the time this section of the country was situated between a high-pressure area to the west and a low to the east. The 6 a. m. pilot-balloon observation of the 27th at Royal Center revealed a north-northeast wind from 500 to 5,000 meters. Both the velocity (10 m. p. s.) and direction of this wind were remarkably steady throughout this great depth. A kite flight made at the same time showed an unusually uniform lapse rate (0.59° C. per 100 meters) from the top of the St. Cu. layer (650 meters) to the maximum altitude reached (5,000 meters) with the relative humidity throughout this layer under 40 per cent.